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Abstract. We review some of the results of our recent work dealing with the novel type of Higgs signals that arise when one considers extensions of the standard model. We discuss first possible deviations on the Higgs couplings due to heavy particles, in the context of the MSSM and with large extra-dimensions. Then, we present several models where it is possible to induce flavor violating Higgs couplings, and probe them at future hadron colliders through the LFV Higgs decay $h \to \tau\mu$ or with rare top decays.

New Physics and novel Higgs signals

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I INTRODUCTION

The discovery of the Higgs boson is certainly one of the most cherished goals of present and future high-energy experiments. In fact, the reported bounds on the Higgs boson mass [1], together with data on neutrinos [2] and CP-violation with B-mesons [3], can be considered some of the most important recent results in Particle Physics, and are already helping us to shape our understanding of flavor physics and electroweak (EW) symmetry breaking. The Higgs boson mass is constrained by radiative corrections to lay in the range 110-185 GeV at 95 % c.l. [1]; such a light Higgs boson (h)is consistent with the prediction of weak scale SUSY, which has become on of the preferred extensions of the SM [4].

The characteristic Higgs boson couplings determine the strategies employed for its search at present and future colliders [5]. For instance, the Higgs-fermion couplings can be studied by open production of $t\bar{t}h, b\bar{b}h$ at hadron colliders or NLC. However, the possible presence of heavy particles associated with physics beyond the SM, can induce corrections to such couplings, which can modify the SM predictions for Higgs production or decays. Heavy particles can also induce tree-level corrections, as it occurs in scenarios with large extra-dimensions, where the KK modes can contribute to the associated production of Higgs with Z boson at NLC, as it will be discussed next.

Flavor violation is another phenomena that could be tested in the Higgs sector. The most widely studied scenarios for Higgs searches, assume that the Flavor-Conserving (FC) Higgs-fermion couplings only depend on the diagonalized fermion mass matrices, while flavor-violating (FV) Higgs transitions are absent or highly suppressed [6]. Indeed, within the SM the Higgs boson-fermion couplings are only sensitive to the fermion mass eigenvalues. However, if one considers extensions of the SM, it is possible to induce new flavored Higgs interactions. These new interactions could be tested through the lepton-flavour violating (LFV) Higgs decays, such as $h \to \tau\mu/\tau e$ [7], which can reach detectable levels in several models that will be discussed next; similarly, these FV scalar interactions can also be tested with the rare decays of the top quark.

II DEVIATIONS OF THE HIGGS COUPLINGS AND